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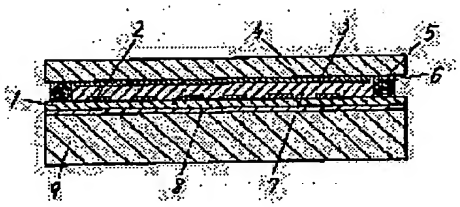
(54) LIQUID CRYSTAL PANEL AND ITS PRODUCTION

(57)Abstract:

PROBLEM TO BE SOLVED: To enhance the uniformity of a panel gap and to obtain the good uniformity of a display.

SOLUTION: A transparent adhesive 8 is applied over the entire part of the rear surface of a first substrate having plural pixel electrodes 2 and a transparent substrate 9 is adhered by the transparent adhesive 8 over the entire part of the rear surface of the first substrate 1. At this time, the first substrate 1, the adhesive 8 and the transparent substrate 9 having nearly the same refractive indices are used so as to prevent the reflection on each other. The first substrate 1 and a second substrate 4 having counter electrodes 3 facing the plural pixel electrodes 2 and color filters are disposed to face each other apart a prescribed interval and both substrates are stuck to each other by sealants in the outer peripheral parts of both substrates. Liquid crystals 7 are sealed between the first substrate 1 and the second substrate 4.



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CLAIMS

[Claim(s)]
[Claim 1] Prepare predetermined spacing and phase opposite of the 1st substrate which has two or more pixel electrodes, and the 2nd substrate which has said two or more pixel electrodes and the counterelectrode which counters is carried out. The liquid crystal panel characterized by having the transparence substrate which is the liquid crystal panel which enclosed liquid crystal between said 1st substrate and said 2nd substrate, and has the almost same refractive index as the refractive index of this 1st substrate at the rear face of said 1st substrate at least.
[Claim 2] The liquid crystal panel characterized by said transparence substrate consisting of borosilicate glass or acrylic resin in a liquid crystal panel according to claim 1.
[Claim 3] Said transparence substrate is a liquid crystal panel characterized by the substrate with which it had this transparence substrate in the liquid crystal panel according to claim 1 or 2, the substrate which counters, and a coefficient of thermal expansion being almost the same.
[Claim 4] This the 1st substrate and refractive index apply the almost same adhesives to the whole rear face of the 1st substrate which has two or more pixel electrodes. Said 1st substrate and the transparence substrate with the almost same refractive index are pasted up with said adhesives on the rear face of said 1st substrate. The manufacture approach of the liquid crystal panel which prepares predetermined spacing, is made to carry out phase opposite of the 2nd substrate which has said 1st substrate and said two or more pixel electrodes, and the counterelectrode which counters, and is characterized by enclosing liquid crystal between said 1st substrate and said 2nd substrate.
[Claim 5] The manufacture approach of the liquid crystal panel according to claim 4 characterized by having equipped with the double-sided pressure sensitive adhesive sheet with this the 1st almost same substrate and, refractive index the whole rear face of the 1st substrate which has two or more pixel electrodes, and pasting up this 1st substrate and the transparence substrate with the almost same refractive index with said double-sided pressure sensitive adhesive sheet on the rear face of said 1st substrate.

[Translation done.]

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a liquid crystal panel and its manufacture approach.
[0002]
[Description of the Prior Art] Generally, a liquid crystal panel is asked for the homogeneity of two substrates spacing (henceforth a panel gap) which counters in order to obtain a good display.
[0003] First, the configuration of the conventional liquid crystal panel is explained using drawing 4 . Drawing 4 (a) shows the outline sectional view of the conventional liquid crystal panel, and drawing 4 (b) shows the outline top

view. As shown in drawing 4 (a), the pixel electrodes 2, such as TFT, are formed on the 1st substrate 1, a predetermined distance is established, phase opposite of the 2nd substrate 4 and 1st substrate 1 equipped with the counterelectrode 3, the color filter (not shown), etc. is carried out, and the periphery section of both substrates is stuck by the sealing compound 6 which has the spacer bead ball 5. Liquid crystal 7 is poured in by the inlet (not shown) between the 1st substrate 1 and the 2nd substrate 4, and a liquid crystal panel is completed by blockading an inlet.

[0004]

[Problem(s) to be Solved by the Invention] By the way, since the poly-Si TFT component was used as a pixel electrode 2 in the liquid crystal panel, the substrate for example, with a quartz substrate expensive as the 1st substrate 1 etc. is used, and the inclination which makes thickness of a quartz substrate thin was suited from the need of reducing cost in recent years. However, the needs which make a screen product large are increasing.

[0005] Then, in the above-mentioned liquid crystal panel, if the 1st substrate 1 is made thin and a screen product is made large, in order for the 1st substrate 1 to curve or to cause deformation, there was a problem that it became difficult to make the panel gap at the time of the lamination of both substrates into homogeneity. Moreover, when the coefficients of thermal expansion of both substrates differed, respectively and the liquid crystal panel was installed into an elevated temperature or low temperature even if the panel gap was uniform, when installing the completed liquid crystal panel at a room temperature, the substrate changed and there was a problem that the homogeneity of a panel gap was lost.

[0006] It is made in order that this invention may solve the above-mentioned technical problem, and the homogeneity of a panel gap is raised, and it aims at offering the display panel which can acquire the homogeneity of a good display, and its manufacture approach.

[0007]

[Means for Solving the Problem] The 1st substrate with which invention of this invention according to claim 1 has two or more pixel electrodes, Prepare predetermined spacing and phase opposite of the 2nd substrate which has said two or more pixel electrodes and the counterelectrode which counters is carried out. It is the liquid crystal panel which enclosed liquid crystal between said 1st substrate and said 2nd substrate, and has the transparence substrate which has the almost same refractive index as the refractive index of this 1st substrate at the rear face of said 1st substrate at least. According to this configuration, a substrate can curve, or deformation of a local substrate can be controlled, and homogeneity of a panel gap can be made high.

[0008] Invention of this invention according to claim 3 is characterized by said transparence substrate having almost the same substrate with which it had this transparence substrate, substrate which counters, and coefficient of thermal expansion in a liquid crystal panel according to claim 1 or 2. According to this configuration, even if heat is added into the production process of a liquid crystal panel or heat is added after completion of a liquid crystal panel, the homogeneity of a high panel gap is maintainable.

[0009] Invention of this invention according to claim 4 applies the adhesives with this the 1st almost same substrate and refractive index to the whole rear face of the 1st substrate which has two or more pixel electrodes. Said 1st substrate and the transparence substrate with the almost same refractive index are pasted up with said adhesives on the rear face of said 1st substrate. Predetermined spacing is prepared, phase opposite of the 2nd substrate which has said 1st substrate and said two or more pixel electrodes, and the counterelectrode which counters is carried out, and liquid crystal is enclosed between said 1st substrate and said 2nd substrate. Since according to this manufacture approach the rear face of the 1st substrate is equipped with the transparence substrate of the rigid high quality of the material when forming a pixel electrode on the 1st substrate, the curvature of the 1st substrate can be made small. Moreover, since the 1st substrate is equipped with the transparence substrate when both substrates are pressurized using **** at the time of the lamination of both substrates, when local deformation of the 1st substrate by a foreign matter etc. can be controlled and both substrates are pressurized with a gas, the curvature of the 1st substrate by the wind pressure can be controlled.

[0010]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained using a drawing.

[0011] Drawing 1 is the outline sectional view of the liquid crystal panel of the gestalt of operation of this invention. In drawing 1 , the same number is attached about what shows the same configuration as the former.

[0012] In drawing 1 , it is prepared on the 1st substrate 1 which consists of a quartz-glass substrate with a thickness of 0.6mm, two or more pixel electrodes 2, for example, elevated-temperature poly-Si TFT. The transparence adhesives 8, such as acrylic adhesives, are applied to the whole rear face of the 1st substrate 1, and the transparence substrate 9 which consists of a borosilicate glass substrate with a thickness of 0.5mm -

about 10mm is pasted up on the whole rear face of the 1st substrate 1 with the transparence adhesives 8. Here, the 1st substrate 1, adhesives 8, and transparence substrate 9 use what has an almost the same refractive index so that it may not reflect mutually. The refractive index of the quartz-glass substrate as the 1st substrate 1 is 1.46, therefore, as for the refractive index of the transparence adhesives 8 and the transparence substrate 9, it is desirable to use the thing of 1.46**1. Prepare predetermined spacing and phase opposite of the 1st substrate 1, and the 2nd substrate 4 which has two or more pixel electrodes 2, the counterelectrode 3 which counters, and a color filter (not shown), for example, borosilicate glass substrate with a thickness of 1.1mm, is carried out. Liquid crystal 7 is enclosed for both substrates between lamination, the 1st substrate 1, and the 2nd substrate 4 by the sealing compound 6 which mixed the spacer bead ball 5 in the periphery section of both substrates.

[0013] Here, a film substrate can also be used as the 1st substrate 1, and as a transparence substrate 9, rigidity can be high, you may use, the transparent resin substrate, for example, the acrylic resin substrate etc., of the quality of the material with light weight etc., and a cheap substrate can be used. Moreover, as transparence adhesives 8, epoxy resin adhesive, silicone system adhesives, etc. can be used in addition to acrylic adhesives. Moreover, a double-sided pressure sensitive adhesive sheet etc. may be used in addition to adhesives.

[0014] Drawing 2 (a) - (c) shows process drawing in the manufacture approach of the liquid crystal panel of this invention.

[0015] As shown in drawing 2 (a), the pixel electrodes 2, such as a TFT component, are formed on the 1st substrate 1. Then, as shown in drawing 2 (b), the transparence adhesives 8 are applied to the whole rear face of the 1st substrate 1, and the transparence substrate 9 of the rigid high quality of the material is pasted up on the whole rear face of this 1st substrate 1 with the transparence adhesives 8. Here, what has an almost the same refractive index is used for the 1st substrate 1, transparence adhesives 8, and transparence substrate 9 so that it may not reflect mutually.

[0016] Here, in order to secure the homogeneity of a panel gap, it is necessary to make the curvature of the 1st substrate 1 small. However, generally the curvature of the 1st substrate 1 increases after formation of the pixel electrode 2 for the stress generated when forming the pixel electrode 2 on the 1st substrate 1. for example, when elevated-temperature poly-Si TFT is formed as a pixel electrode 2 on the quartz-glass substrate of 2 125mm and it does not have the transparence substrate 9 by the thickness of 0.6mm When the curvature of the 1st substrate 1 is equipped with 12 micrometers - about 22 micrometers of transparence substrates 9 to generally curving around 17 micrometers after forming the pixel electrode 2, curvature can be suppressed from 1 micrometer to about 3 micrometers around 2 micrometers.

[0017] Next, as shown in drawing 2 (c), predetermined spacing is prepared, phase opposite of the 1st substrate 1 on which the transparence substrate 9 was pasted up, and the 2nd substrate 4 equipped with the counterelectrode 3, the color filter (not shown), etc. is carried out, and both substrates are stuck by the sealing compound 6 which has the spacer bead ball 5 arranged at the periphery section of the 1st substrate 1 or the 2nd substrate 4. Then, liquid crystal 7 is poured in by the liquid crystal inlet (not shown), and a liquid crystal panel is completed by blockading an inlet. Or liquid crystal 7 is dropped at the substrate which has arranged the sealing compound 6 after having arranged the sealing compound 6 in the periphery section of the 1st substrate 1 or the 2nd substrate 4, the 1st substrate 1 and 2nd substrate 4 are stuck after that, and a liquid crystal panel is completed.

[0018] Here, although it sticks by pressing both substrates by **** or usually applying a wind pressure with a gas when sticking the 1st substrate 1 and 2nd substrate 4, about 1kg/cm2 pressurization is then needed. In the production process of the conventional liquid crystal panel which is not equipped with the transparence substrate 9, when pressurizing both substrates using **** and a foreign matter invades between **** and the 1st substrate 1, a panel gap changes [deformation by pressurization] locally that the substrate is easier than a foreign matter, and the homogeneity of a panel gap is spoiled greatly. Generally it is proportional to the square of the thickness of a substrate, the ease, i.e., the young elastic modulus, of deformation of a substrate.

[0019] According to this invention, since the 1st substrate 1 is equipped with the transparence substrate 9 of the rigid high quality of the material, a local change of the gap by the above-mentioned foreign matter can be controlled. Moreover, a uniform panel gap can be obtained between the 1st substrate 1 and the 2nd substrate 4, without the 1st substrate 1 curving, since the 1st substrate 1 is equipped with the transparence substrate 9 although the stress by the wind pressure is applied to a substrate at the time of lamination when pressurizing with a gas.

[0020] In addition, in order to secure the homogeneity of a panel gap when carrying out adhesion hardening of the 1st substrate 1 and 2nd substrate 4 equipped with the transparence substrate 9 by the sealing compound 6, and

there is the need for heating, what has the same coefficient of thermal expansion of the 2nd substrate 4 and the transparence substrate 9 is desirable.

[0021] Moreover, when the 1st substrate 1 equipped with the transparence substrate 9 and the 2nd substrate 4 are the ingredients with which coefficients of thermal expansion differ, adhesion hardening of the sealing compound 6 is carried out and there is no need for heating, it is desirable to use ultraviolet curing mold acrylic adhesives with high bond strength.

[0022] Since it has about 1000-degree C heat treatment process in case the pixel electrode 2 is formed when manufacturing the liquid crystal panel of an elevated-temperature poly-Si TFT method, it is necessary to use quartz glass as the 1st substrate 1. On the other hand, since the 2nd substrate 4 does not have a heat treatment process 300 degrees C or more, general comparatively cheap borosilicate glass can be used for it. The coefficients of thermal expansion of quartz glass and borosilicate glass are 5.3x10-7/K, and 46x10-7/K respectively. Therefore, the amounts of telescopic motion of two glass substrates according [the liquid crystal panel after lamination] to heat differ about 8 times. Furthermore, if the completed liquid crystal panel is installed into an elevated temperature or low temperature, the amounts of telescopic motion of both substrates differ. And since only the periphery section of both substrates is pasted up by the sealing compound 6, both substrates change to an ununiformity and, as a result, the homogeneity of a panel gap is spoiled.

[0023] However, according to this invention, since the transparence substrate 9 with the same coefficient of thermal expansion of the 2nd substrate 4 is formed in the rear face of the 1st substrate 1, the difference in the amount of telescopic motion of the 1st substrate 1 by this thermal change and the 2nd substrate 4 can be eased, and change of a panel gap can be controlled.

[0024] In addition, in the gestalt of the above-mentioned implementation, although the case where the transparence substrate 9 was formed in the 1st substrate 1 was explained, even if it pastes up the transparence substrate 9 on the substrate of both the 2nd substrate 4 or the 1st substrate 1, and the 2nd substrate 4, the same effectiveness as the above can be acquired.

[0025] Moreover, in the gestalt of the above-mentioned implementation, although the TFT mold liquid crystal panel was explained, it cannot be overemphasized that it can carry out also in a simple matrix liquid crystal panel, an MIM mold liquid crystal panel, etc.

[0026] Drawing 3 is the schematic diagram of the optical system at the time of projecting the image of the liquid crystal panel of this invention on a screen. The display image of a liquid crystal panel connects a focus on a screen 11 through the projection lens 10. When a foreign matter 12 adheres to the front face of the transparence substrate 9 in the liquid crystal panel of this invention, the focus of a foreign matter 12 is recognized as a punctiform stain on eye a join pig and image quality in the location which shifted from a part for the thickness of the 1st substrate 1 and the transparence substrate 9, and the screen 11. While becoming large, contrast falls and it is hard coming to recognize a punctiform stain, so that a gap of the focal location of a foreign matter 12 and the location of a screen 11 becomes large. When the liquid crystal panel of 1.3 inches of vertical angles is projected on 40 inches, the punctiform stain according [the sum total of the thickness of the 1st substrate 1 and the transparence substrate 9] to the foreign matter 12 1mm or less at 5mm or more has not been recognized on a screen.

[0027] In addition, the effectiveness which prevents the improvement in the permeability of a liquid crystal panel and malfunction of the pixel electrode 2 by the reflected light in a front face can be given by performing nonreflective coating to the field opposite to the adhesion side of the transparence substrate 9.

[0028]

[Effect of the Invention] The 1st substrate which has two or more pixel electrodes as mentioned above according to the liquid crystal panel of this invention, Prepare predetermined spacing and phase opposite of the 2nd substrate which has said two or more pixel electrodes and the counterelectrode which counters is carried out. It is the liquid crystal display panel which enclosed liquid crystal between said 1st substrate and said 2nd substrate. Since the rear face of the 1st substrate is equipped with the transparence substrate which has the almost same refractive index as the refractive index of this 1st substrate at least, the curvature of a substrate and local deformation can be controlled, homogeneity of a panel gap can be made high, and good display quality can be acquired.

[0029] Moreover, since according to the manufacture approach of the liquid crystal panel of this invention the rear face of the 1st substrate is equipped with the transparence substrate of the rigid high quality of the material when forming a pixel electrode on the 1st substrate, the curvature of the 1st substrate can be made small and the homogeneity of a panel gap can be secured. Moreover, since the 1st substrate is equipped with the

transparence substrate when both substrates are pressurized using **** at the time of the lamination of both substrates, when local deformation of the 1st substrate by a foreign matter etc. can be controlled and both substrates are pressurized with a gas, the curvature of the 1st substrate by the wind pressure can be controlled.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of the liquid crystal panel in the gestalt of 1 operation of this invention
[Drawing 2] Process drawing of the liquid crystal panel in the gestalt of 1 operation of this invention
[Drawing 3] The schematic diagram of the optical system when projecting with the liquid crystal panel of this invention
[Drawing 4] (a) The sectional view of the conventional liquid crystal panel
(b) This top view
[Description of Notations]
1 1st Substrate
2 Pixel Electrode
3 Counterelectrode
4 2nd Substrate
7 Liquid Crystal
8 Transparence Adhesives
9 Transparence Substrate

[Translation done.]